

VIKING LABORATORIES INC.

INSTRUCTION MANUAL

Type 200 Waveform Synthesizer with Type G Plug-in

TYPE 200 - This synthesizer can generate any waveform which can be described by a mathematical equation. It can generate sine waves, square waves, triangular waves, and any other waveform which can be described by a mathematical equation. It can also generate complex waveforms which are the sum of two or more simple waveforms.

TYPE 200 - This synthesizer can generate any waveform which can be described by a mathematical equation. It can generate sine waves, square waves, triangular waves, and any other waveform which can be described by a mathematical equation. It can also generate complex waveforms which are the sum of two or more simple waveforms.

TYPE 200 - This synthesizer can generate any waveform which can be described by a mathematical equation. It can generate sine waves, square waves, triangular waves, and any other waveform which can be described by a mathematical equation. It can also generate complex waveforms which are the sum of two or more simple waveforms.

SECTION I

DESCRIPTION AND CHARACTERISTICS

GENERAL DESCRIPTION

THE TYPE 200 WAVEFORM SYNTHESIZER IS THE BASIC UNIT OF A WAVEFORM SYNTHESIZING SYSTEM. THE TYPE 200 IS DESIGNED FOR USE WITH ANY OF SEVERAL AVAILABLE EXACT PLUG-IN UNITS (I.E. TYPE B, C, D, E, F OR G).

WITH THE TYPE 200 AND ITS ASSOCIATED PLUG-IN UNITS, YOU CAN ELECTRONICALLY COMPOSE AN INFINITE VARIETY OF COMPLEX WAVESHAPES WITHIN A WIDE FREQUENCY RANGE.

THE TYPE 200 CONSISTS OF A PRIMARY AND A SECONDARY MATRIX, HORIZONTAL AND VERTICAL STEPPING COUNTERS AND A POWER SUPPLY. THE POWER SUPPLY ALSO FURNISHES POWER FOR THE PLUG-IN UNITS.

THE FOLLOWING IS A GENERAL GUIDE SHOWING SOME OF THE BASIC CAPABILITIES OF THE TYPE 200 WITH EACH OF THE AVAILABLE PLUG-IN UNITS. FOR MORE DETAILED SPECIFICATIONS ON A GIVEN PLUG-IN UNIT, SEE THE APPROPRIATE SECTION OF THIS INSTRUCTION MANUAL.

TYPE B - - - - - PROVIDES INDEPENDENTLY VARIABLE SLOPE AND WIDTH OF EACH INCREMENT UP TO 50 INCREMENTS. COMBINES THE SLOPE GENERATION OF THE G UNIT AND THE VARIABLE WIDTH PER INCREMENT OF THE C UNIT.

TYPE C - - - - - PROVIDES ADJUSTABLE AMPLITUDE AND WIDTH OF EACH INCREMENT UP TO 50 INCREMENTS. TOTAL DURATION OF THE COMPLETE CYCLE (OR PROGRAM) IS EQUAL TO THE SUM OF THE WIDTHS OF ALL THE INCREMENTS IN USE.

TYPE D - - - - - PROVIDES TWO SIMULTANEOUS AND SEPARATE OUTPUTS. EACH OUTPUT CONSISTS OF UP TO 50 INCREMENTS WITH THE SLOPE OF EACH INCREMENT ADJUSTABLE. ADJUSTMENT OF ANY INDIVIDUAL INCREMENT AUTOMATICALLY VARIES THE AMPLITUDE OF THE START OF THE FOLLOWING INCREMENT, RESULTING IN A CONTINUOUS WAVEFORM OF VARYING SLOPES.

TYPE E - - - - - AN EXTENDED PROGRAM PLUG-IN UNIT THAT PROVIDES UP TO ONE HUNDRED INCREMENTS PER PROGRAM WITH ADJUSTABLE AMPLITUDE OF EACH INCREMENT.

TYPE F - - - - - PROVIDES ADJUSTABLE SLOPE AND AMPLITUDE OF EACH INCREMENT UP TO 50 INCREMENTS. A SLOPES ONLY OUTPUT PROVIDES CONTINUOUS SLOPES WITH THE AMPLITUDE AT THE BEGINNING OF EACH INCREMENT THE SAME AS THE AMPLITUDE AT THE END OF THE PRECEDING INCREMENT. A MIXED OUTPUT PROVIDES AN OUTPUT PROGRAM WITH COMBINED CONTROL OF SLOPE AND AMPLITUDE. VARYING THE SLOPE OF AN INCREMENT VARIES THE START OF THE NEXT INCREMENT THE SAME AMOUNT, ALTHOUGH IT MAY BE ADJUSTED TO A DIFFERENT AMPLITUDE.

TYPE G - - - - - PRODUCES A PUSH-PULL OR MIRROR IMAGE COMPLEX WAVEFORM OF 50-VOLT (MAXIMUM) AMPLITUDE. A "CLAMP" ADJUSTMENT ALLOWS THE DC LEVEL OF THE FIRST INCREMENT TO BE SET INDEPENDENT OF SLOPE ADJUSTMENT TO KEEP THE WAVEFORM FROM SHIFTING AND TO CAUSE IT TO ALWAYS START AT THE SAME LEVEL REGARDLESS OF THE TRIGGER SOURCE. ONLY THE SECONDARY MATRIX IS USED TO PROGRAM THE SLOPES SO THAT THE AUXILIARY DIGITAL OR BIT OUTPUT OF THE PRIMARY MATRIX MAY BE USED AS AN INDEPENDENT PROGRAMMER.

GENERAL CHARACTERISTICS OF THE TYPE 200

RISETIME/FALLTIME

0.3 μ sec.

POWER SUPPLIES

ELECTRONICALLY REGULATED VOLTAGES OF -210, -60, +100 AND +250 VOLTS, $\pm 3\%$.

LINE POWER

105-125 VOLTS AT 50-60 CPS, 375 WATTS.

MECHANICAL

CONSTRUCTION: ALUMINUM ALLOY CHASSIS WITH A PHOTO-ETCHED, CERAMICIZED ALUMINUM FRONT PANEL. WEIGHT (TYPE 200 WITHOUT PLUG-IN): 50 LBS NET, 64 LBS GROSS. WEIGHT (TYPE 200 WITH PLUG-IN): 57 LBS NET, 70 LBS GROSS. DIMENSIONS: 17-1/2" (W) X 15-1/2" (H) X 14" (D).

SECTION 2

OPERATING INSTRUCTIONS

GENERAL

THIS SECTION OF THE MANUAL DESCRIBES THE FRONT-PANEL CONTROLS OF THE TYPE 200. IN ADDITION, ABBREVIATED OPERATING INSTRUCTIONS ARE GIVEN FOR EACH PLUG-IN UNIT. DETAILED OPERATING INSTRUCTIONS APPEAR IN THE PLUG-IN SECTION.

FRONT PANEL CONTROLS

ON-OFF POWER SWITCH

Turns the unit off or on. A red panel lamp lights when the power is on.

PROGRAM LEVEL CONTROLS

FIFTY DUAL CONTROLS SET THE AMPLITUDE AND SHAPE OF THE OUTPUT WAVEFORM. ARRANGED IN FIVE HORIZONTAL ROWS (A, B, C, D AND E) OF TEN EACH. THE BLACK KNOBS SET THE OUTPUT OF THE PRIMARY MATRIX. THE RED KNOBS SET THE OUTPUT OF THE SECONDARY MATRIX INCREMENTS.

ROW SWITCHES

FOUR SLIDE SWITCHES PUT ROW B, C, D OR E IN OR OUT OF THE PROGRAM.

NEON INDICATORS

TEN NEON LAMPS ABOVE THE "A" ROW SHOW WHICH INCREMENT IS PRESENT AT THE OUTPUT, WHILE FIVE NEON LAMPS AT THE END OF EACH ROW SHOW THE ROW IN USE.

PROGRAMMING

1. ALWAYS START SETTING UP A PROGRAM WITH INCREMENT #1, ROW "A" (UPPER LEFT-HAND CONTROL), AND MOVE TO THE RIGHT ACROSS THE ROW. AFTER COMPLETING ROW "A", MOVE TO THE ROW BELOW AND REPEAT AS IN ROW "A". SWITCH OFF ANY ROWS THAT ARE NOT NEEDED. CONTINUE TO SET EACH CONTROL UNTIL YOU REACH THE TENTH INCREMENT IN ROW "E". THIS IS THE LAST INCREMENT OF THE PROGRAM WHEN A FULL 50-INCREMENT PROGRAM IS USED.
2. ANY ROW EXCEPT ROW "A" CAN BE SWITCHED OUT OF A PROGRAM. FOR EXAMPLE, IF THE ROW "B" SLIDE SWITCH IS SET TO OUT, THE PROGRAM WILL STEP FROM THE TENTH INCREMENT IN ROW "A" TO THE FIRST INCREMENT IN ROW "C". IF ALL THE ROW SWITCHES ARE SET TO OUT, ONLY THE PROGRAM OF ROW "A" WILL BE IN OPERATION.

NOTE

IF A ROW IS SWITCHED OUT WHILE THE INCREMENTS IN THAT ROW ARE BEING COUNTED, ONLY THE ROW THAT IS SWITCHED OUT WILL CONTINUE TO OPERATE. TO AVOID THIS, TURN THE TIME/INCREMENT SWITCH ON THE PLUG-IN UNIT TO ITS SLOWEST SPEED AND SWITCH THE DESIRED ROW OUT WHILE IT IS NOT IN OPERATION.

PLUG-IN UNIT

OPERATING INSTRUCTIONS

THE FOLLOWING INFORMATION IS AN ABBREVIATED OPERATING PROCEDURE FOR EACH PLUG-IN UNIT. THE INSTRUCTIONS WILL DEMONSTRATE THE BASIC FEATURES OF EACH UNIT. FOR DETAILED OPERATING INSTRUCTIONS, SEE THE PLUG-IN UNIT SECTION OF THE MANUAL.

TYPE B PLUG-IN UNIT

INSERT THE TYPE B FIRMLY INTO THE PLUG-IN COMPARTMENT OF THE TYPE 200 AND TIGHTEN THE SECURING SCREW. TURN ON THE POWER AND ALLOW A FEW MINUTES FOR THE SYSTEM TO REACH OPERATING TEMPERATURE.

1. CONNECT A COAXIAL CABLE FROM THE MAIN OUTPUT CONNECTOR OF THE TYPE B TO THE MONITOR OSCILLOSCOPE VERTICAL INPUT. SET THE SWEEP RATE OF THE OSCILLOSCOPE TO 500 SEC/DIV.
2. CONNECT A JUMPER CABLE FROM THE TRIGGER OUT JACK OF THE TYPE B TO THE EXTERNAL TRIGGER INPUT OF THE MONITOR OSCILLOSCOPE.
3. TURN ON ALL ROW SWITCHES OF THE TYPE 200.
4. PRESET THE FRONT PANEL CONTROLS OF THE TYPE B AS FOLLOWS:

SLOPE BALANCE	MIDRANGE
TIME/INCREMENT	100 μ SEC
TRIGGER SOURCE	INT
TRIGGER MODE	NORMAL
EXPANSION AMPLITUDE	CALIBRATED

5. YOU SHOULD OBSERVE A RANDOM WAVEFORM OF FIFTY SLOPES OR INCREMENTS, EACH WITH A DURATION OF 100 μ SEC. ADJUST THE OSCILLOSCOPE TRIGGERING SO THAT THE NO. 1 INCREMENT IS AT THE START OF THE TRACE.
6. VARY THE SECONDARY MATRIX KNOBS (RED) AND NOTE THE INDIVIDUAL SLOPES AS THEY VARY. THE FOLLOWING INCREMENTS WILL CHANGE LEVEL SINCE THE FINISH POINT FOR ONE SLOPE IS THE START POINT OF THE NEXT.
7. THE PRIMARY MATRIX KNOBS (BLACK) WILL HAVE NO EFFECT ON THE DISPLAY AND SHOULD BE ALL TURNED CCW.
8. CHANGE THE TIME PER INCREMENT SWITCH AND NOTICE THE INCREMENT TIME VARIES BUT THE WAVEFORM RATIO REMAINS THE SAME.
9. TURN EXPANSION KNOB TO MAXIMUM. VARY THE PRIMARY MATRIX (RED) CONTROLS AND NOTICE THAT THE WIDTH OF THE VARIOUS INCREMENTS CHANGES FROM 100 μ SEC TO 2000 μ SEC. TOTAL TIME OF ONE PROGRAM IS THE SUM OF THE INDIVIDUAL INCREMENT TIMES.
10. SLOPE BALANCE MAY HAVE TO BE ADJUSTED FOR EACH TIMING RANGE.

PLUG-IN UNIT OPERATING INSTRUCTIONS (CONTINUED)

TYPE C PLUG-IN UNIT

INSERT THE TYPE C FIRMLY INTO THE PLUG-IN COMPARTMENT OF THE TYPE 200 AND TIGHTEN THE SECURING SCREW. TURN ON THE POWER AND ALLOW A FEW MINUTES FOR THE SYSTEM TO REACH OPERATING TEMPERATURE.

1. CONNECT A COAXIAL CABLE FROM THE MAIN OUTPUT CONNECTOR OF THE TYPE C TO A MONITOR OSCILLOSCOPE VERTICAL INPUT. SET THE SWEEP RATE OF THE MONITOR OSCILLOSCOPE TO 5 MSEC/DIV.
2. CONNECT A JUMPER CABLE FROM THE TYPE C TRIGGER OUT JACK TO THE EXTERNAL TRIGGER INPUT ON THE MONITOR OSCILLOSCOPE
3. TURN ON ALL ROW SWITCHES OF THE TYPE 200.
4. PRESET THE FRONT PANEL CONTROLS OF THE TYPE C AS FOLLOWS:

OUTPUT AMPLITUDE	MIDRANGE
TIME/INCREMENT	100 μ SEC
TRIGGER SOURCE	INTERNAL
TRIGGER MODE	NORM.

5. SET THE TRIGGERING CONTROLS OF THE OSCILLOSCOPE FOR A STABLE PRESENTATION.
6. TURN ALL SECONDARY MATRIX (RED) CONTROLS FULLY COUNTERCLOCKWISE. AT THIS POINT, YOU SHOULD BE OBSERVING THE DISPLAY OF A COMPLETE 50-INCREMENT PROGRAM. EACH INCREMENT SHOULD BE 100 μ SEC LONG.
7. VARY THE SECONDARY MATRIX (RED) CONTROLS AND NOTICE THAT THE WIDTH OF THE VARIOUS INCREMENTS CHANGES FROM 100 μ SEC TO 2000 μ SEC. TOTAL TIME OF ONE PROGRAM IS THE SUM OF THE INDIVIDUAL INCREMENT TIMES.
8. VARY THE PRIMARY MATRIX (BLACK) CONTROLS AND NOTICE THAT THE AMPLITUDE OF THE VARIOUS INCREMENTS CHANGES OVER A 30-VOLT RANGE.
9. CHANGE THE SETTING OF THE TIME/INCREMENT SWITCH AND NOTICE THE CHANGE IN TIME OF THE INCREMENTS. THE INCREMENTS CHANGE IN TIME AS A GROUP, BUT THE RATIO IN TIME OF ONE INCREMENT TO ANOTHER REMAINS THE SAME.

PLUG-IN UNIT OPERATING INSTRUCTIONS (CONTINUED)

TYPE D PLUG-IN UNIT

INSERT THE TYPE D FIRMLY INTO THE PLUG-IN COMPARTMENT OF THE TYPE 200 AND TIGHTEN THE SECURING SCREW. TURN ON THE POWER AND ALLOW A FEW MINUTES FOR THE SYSTEM TO REACH OPERATING TEMPERATURE.

1. CONNECT A COAXIAL CABLE FROM THE SLOPES-PRIMARY CONNECTOR OF THE TYPE D TO A MONITOR OSCILLOSCOPE VERTICAL AMPLIFIER INPUT. SET THE SWEEP RATE OF THE MONITOR OSCILLOSCOPE TO 5 msec/div.
2. CONNECT A JUMPER CABLE FROM THE TYPE D TRIGGER OUT JACK TO THE EXTERNAL TRIGGER INPUT ON THE MONITOR OSCILLOSCOPE.
3. TURN ON ALL ROW SWITCHES OF THE TYPE 200.
4. PRESET THE FRONT PANEL CONTROLS OF THE TYPE D AS FOLLOWS:

OUTPUT AMPLITUDE	MIDRANGE
TIME/INCREMENT	100 μ sec
TRIGGER SOURCE	INTERNAL
TRIGGER MODE	NORMAL

5. SET THE TRIGGERING CONTROLS OF THE OSCILLOSCOPE FOR A STABLE PRESENTATION. AT THIS POINT, YOU SHOULD BE OBSERVING ONE OF THE TWO OUTPUT PROGRAMS. THIS PROGRAM (AS DOES THE OTHER PROGRAM) SHOULD CONTAIN FIFTY INCREMENTS THAT ARE 100 μ sec LONG.

PLUG-IN UNIT OPERATING INSTRUCTIONS (CONTINUED)

TYPE E PLUG-IN UNIT

INSERT THE TYPE E FIRMLY INTO THE PLUG-IN COMPARTMENT OF THE TYPE 200 AND TIGHTEN THE SECURING SCREW. TURN ON THE POWER AND ALLOW A FEW MINUTES FOR THE SYSTEM TO REACH OPERATING TEMPERATURE.

1. CONNECT A COAXIAL CABLE FROM THE MAIN OUTPUT CONNECTOR OF THE TYPE E TO A MONITOR OSCILLOSCOPE VERTICAL INPUT. SET THE SWEEP RATE OF THE OSCILLOSCOPE TO 100 $\mu\text{sec}/\text{DIV}$.
2. CONNECT A JUMPER CABLE FROM THE TYPE E PRIMARY AND SECONDARY TRIGGER OUT JACK TO THE EXTERNAL TRIGGER INPUT OF THE MONITOR OSCILLOSCOPE.
3. TURN ON ALL ROW SWITCHES OF THE TYPE 200.
4. PRESET THE FRONT PANEL CONTROLS OF THE TYPE E PLUG-IN AS FOLLOWS:

OUTPUT AMPLITUDE	MIDRANGE
TIME/INCREMENT	100 μsec (VARIABLE CLOCKWISE)
TRIGGER SOURCE	INTERNAL
MATRIX MODE	PRI AND SEC.
TRIGGER MODE	NORMAL

5. TRIGGER THE OSCILLOSCOPE ON THE NO. 1 INCREMENT IN ROW "A". YOU SHOULD OBSERVE APPROXIMATELY 10 INCREMENTS OF DIFFERENT VOLTAGE LEVELS. VARY THE PRIMARY KNOBS (BLACK) OF ROW "A"; THE INCREMENT VOLTAGE LEVELS SHOULD CHANGE.
6. SET THE TIME PER INCREMENT SWITCH TO 10 μsec , THE FULL 100 INCREMENTS SHOULD APPEAR ON THE OSCILLOSCOPE.

PLUG-IN UNIT OPERATING INSTRUCTIONS (CONTINUED)

TYPE F PLUG-IN UNIT.

INSERT THE TYPE F FIRMLY INTO THE PLUG-IN COMPARTMENT OF THE TYPE 200 AND TIGHTEN THE SECURING SCREW. TURN ON THE POWER AND ALLOW A FEW MINUTES FOR THE SYSTEM TO REACH OPERATING TEMPERATURE.

1. CONNECT A COAXIAL CABLE FROM THE SLOPES ONLY CONNECTOR OF THE TYPE F TO THE MONITOR OSCILLOSCOPE VERTICAL INPUT. SET THE SWEEP RATE OF THE OSCILLOSCOPE TO 500 μ SEC/DIV.
2. CONNECT A JUMPER CABLE FROM THE TRIGGER OUT JACK OF THE TYPE F TO THE EXTERNAL TRIGGER INPUT OF THE MONITOR OSCILLOSCOPE.
3. TURN ON ALL ROW SWITCHES OF THE TYPE 200.
4. PRESET THE FRONT PANEL CONTROLS OF THE TYPE F AS FOLLOWS:

OUTPUT AMPLITUDE	MIDRANGE
TIME/INCREMENT	100 μ SEC
TRIGGER SOURCE	INTERNAL
TRIGGER MODE	NORMAL

5. YOU SHOULD OBSERVE A RANDOM WAVEFORM OF FIFTY SLOPES OR INCREMENTS, EACH WITH A DURATION OF 100 μ SEC. ADJUST THE OSCILLOSCOPE TRIGGERING SO THAT THE NO. 1 INCREMENT IS AT THE START OF THE TRACE.
6. VARY THE SECONDARY MATRIX KNOBS (RED) AND NOTE THE INDIVIDUAL SLOPES AS THEY VARY. THE FOLLOWING INCREMENTS WILL CHANGE LEVEL SINCE THE FINISH POINT FOR ONE SLOPE IS THE START POINT OF THE NEXT.
7. THE PRIMARY MATRIX KNOBS (BLACK) WILL HAVE NO EFFECT ON THE DISPLAY AND SHOULD BE ALL TURNED CCW.
8. CHANGE THE TIME PER INCREMENT SWITCH AND NOTICE THE INCREMENT TIME VARIES BUT THE WAVEFORM RATIO REMAINS THE SAME.

PLUG-IN UNIT OPERATING INSTRUCTIONS (CONTINUED)

TYPE G PLUG-IN UNIT

INSERT THE TYPE G FIRMLY INTO THE PLUG-IN COMPARTMENT OF THE TYPE 200 AND TIGHTEN THE SECURING SCREW. TURN ON THE POWER AND ALLOW A FEW MINUTES FOR THE SYSTEM TO REACH OPERATING TEMPERATURE.

1. CONNECT A COAXIAL CABLE FROM THE + MAIN OUTPUT CONNECTOR OF THE TYPE G TO THE MONITOR OSCILLOSCOPE VERTICAL INPUT. SET THE SWEEP RATE OF THE OSCILLOSCOPE TO $500\mu\text{sec}/\text{DIV}$.
2. CONNECT A JUMPER CABLE FROM THE MULTI ROW JACK OF THE TYPE G TO THE EXTERNAL TRIGGER INPUT OF THE MONITOR OSCILLOSCOPE.
3. TURN ON ALL ROW SWITCHES OF THE TYPE 200.
4. PRESET THE FRONT PANEL CONTROLS OF THE TYPE G AS FOLLOWS:

CLAMP ADJ.	MIDRANGE
OUTPUT AMPLITUDE	MIDRANGE
TIME/INCREMENT	$100\mu\text{sec}$
TRIGGER MODE	INTERNAL
MAIN OUTPUT	NORMAL

5. YOU SHOULD OBSERVE A RANDOM WAVEFORM OF 50 SLOPES OR INCREMENTS, EACH WITH A DURATION OF $100\mu\text{sec}$. ADJUST THE OSCILLOSCOPE TRIGGERING SO THAT THE NO. 1 INCREMENT IS AT THE START OF THE TRACE.
6. VARY THE SECONDARY MATRIX KNOBS (RED) AND NOTE THE INDIVIDUAL SLOPES VARY. THE FOLLOWING INCREMENTS WILL CHANGE LEVEL SINCE THE FINISH POINT FOR ONE SLOPE IS THE START POINT OF THE NEXT.
7. THE PRIMARY MATRIX KNOBS (BLACK) WILL HAVE NO EFFECT ON THE DISPLAY AND SHOULD BE ALL TURNED CCW.
8. CHANGE THE TIME PER INCREMENT SWITCH AND NOTICE THE INCREMENT TIME VARIES BUT THE WAVEFORM RATIO REMAINS THE SAME.
9. TURN MAIN OUTPUT TO CLAMP. INCREMENT NO. 1 MAY NOW BE ADJUSTED TO THE DESIRED DC LEVEL WITH THE CLAMP ADJ. INCREMENT NO. 2 WILL NOW BE THE BEGINNING SLOPE OF THE WAVEFORM.

SECTION 3

CIRCUIT DESCRIPTION

GENERAL INFORMATION

THE TYPE 200 CONTAINS FOUR MAIN CIRCUITS: POWER SUPPLY, VERTICAL RING COUNTER, HORIZONTAL RING COUNTER AND THE TWO MATRIX NETWORKS.

THE VERTICAL RING COUNTER HAS FIVE SECTIONS, ONE FOR EACH HORIZONTAL MATRIX ROW. THE VERTICAL COUNTER SWITCHES TO THE NEXT ROW ON RECEIPT OF A TRIGGER SIGNAL FROM THE HORIZONTAL COUNTER. IF A GIVEN ROW SWITCH IS TURNED OFF, THE COUNTER SKIPS THAT ROW AND AUTOMATICALLY SWITCHES TO THE NEXT ON ROW.

THE HORIZONTAL RING COUNTER HAS TEN SECTIONS, ONE FOR EACH VERTICAL MATRIX ROW. THE HORIZONTAL COUNTER SWITCHES ON IMPULSE FROM THE PLUG-IN UNIT.

THERE ARE TWO SEPARATE MATRIX NETWORKS, PRIMARY AND SECONDARY. BOTH ARE CONVENTIONAL DIODE MATRIX CIRCUITS. A GIVEN INCREMENT IS SELECTED BY FORWARD BIASING A GIVEN MATRIX DIODE WITH A COMBINATION OF THE TWO COUNTER CIRCUITS. EACH DIODE IS CONNECTED TO A POTENTIOMETER. WHEN THE PARTICULAR DIODE IS FORWARD BIASED, THE VOLTAGE SET BY THE POTENTIOMETER APPEARS AT THE OUTPUT OF THE MATRIX. THIS VOLTAGE CORRESPONDS TO THE VOLTAGE OF ONE OF THE INCREMENTS IN THE COMPLETE PROGRAM.

POWER SUPPLY

THE POWER SUPPLY OF THE TYPE 200 FURNISHES REGULATED VOLTAGES TO ALL THE CIRCUITS, EXCEPT FILAMENTS, IN THE TYPE 200 AND THE PLUG-IN UNIT.

THE POWER SUPPLY PROVIDES SERIES REGULATED VOLTAGES OF -210, -60, (TO THE MATRIX NETWORKS ONLY), +100 AND +250 VOLTS. ALL SUPPLIES ARE REFERENCED TO THE -210-VOLT SUPPLY WHICH IS, IN TURN, REFERENCED TO VOLTAGE REGULATOR TUBE V104.

THE -210-VOLT SUPPLY OPERATES AS FOLLOWS: ONE SIDE OF THE OUTPUT OF THE BRIDGE RECTIFIER (D109, D110, D111 AND D112) IS CONNECTED TO THE PLATES OF V101. THE CATHODES OF V101 ARE TIED TO GROUND. THE OTHER OUTPUT SIDE OF THE BRIDGE RECTIFIER IS CONNECTED TO THE LOAD. ALL CURRENT THROUGH THE LOAD MUST PASS THROUGH V101. V101 REGULATES THE VOLTAGE ACROSS THE LOAD BY CONTROLLING THE AMOUNT OF CURRENT THROUGH THE LOAD.

V101 IS CONTROLLED BY V102, V103 AND V104. THE ACTION OF THESE TUBES IS SUCH THAT IF THE VOLTAGE ACROSS THE LOAD ATTEMPTS TO INCREASE, A MORE NEGATIVE BIAS WILL BE PLACED ON THE GRID OF V101. WITH MORE NEGATIVE BIAS, V101 DROPS MORE VOLTAGE AND CAUSES A CORRECTIVE DECREASE OF THE VOLTAGE ACROSS THE LOAD. IF THE VOLTAGE ACROSS THE LOAD DECREASES, THE BIAS ON V101 DECREASES, LESS VOLTAGE IS DROPPED BY C101, AND THE VOLTAGE ACROSS THE LOAD MAKES A CORRECTIVE INCREASE.

REGULATION OF THE +100 AND +250 VOLT SUPPLIES IS VERY SIMILAR. IN THE +100 VOLT SUPPLY, V107A IS THE SERIES REGULATOR TUBE AND V106 IS THE CONTROL TUBE.

CIRCUIT DESCRIPTION (CONTINUED)

VERTICAL COUNTER

THE VERTICAL COUNTER IS A FIVE-SECTION RING COUNTER THAT "ENABLES" THE HORIZONTAL ROWS OF THE PRIMARY AND SECONDARY MATRIX NETWORKS.

WHEN THE INSTRUMENT IS TURNED ON, ONLY ONE ROW OF THE FIVE TRIGGER TUBES (V303, V306, V309, V312 OR V316) WILL TURN ON. THIS CAUSES ONE OF THE MULTIVIBRATORS (V302, V305, V308, V311 OR V315) TO CHANGE STATE WHICH, IN TURN, DRIVES ONE OF THE MATRIX "ENABLE" TUBES (V301, V304, V307, V310 OR V314) INTO CONDUCTION. FOR EXAMPLE, CONSIDER THE CIRCUIT OF V301 WHEN IT IS TURNED ON. ITS GRID VOLTAGE IS REDUCED TO GROUND WHEN MULTIVIBRATOR V302 CHANGES STATE. THIS PLACES THE CATHODE OF V301 NEAR GROUND AND NEON LAMP B301 TURNS ON. IN ADDITION, ONE SIDE OF EACH ROW "A" MATRIX (PRIMARY AND SECONDARY) IS BROUGHT NEAR GROUND AND DIODES D201 THROUGH D210 ARE FORWARD BIASED AND THE VOLTAGE SET BY EACH CONTROL IS APPLIED TO A CATHODE FOLLOWER GRID. THUS, THE ENTIRE ROW IN BOTH THE PRIMARY AND SECONDARY MATRIX NETWORKS HAS BEEN "ENABLED." THE HORIZONTAL COUNTER THEN ENABLES THE INDIVIDUAL TUBES IN THE ROW IN A 1 THROUGH 10 SEQUENCE. AT THE END OF THE HORIZONTAL COUNTER SCAN, A TRIGGER PULSE SHIFTS THE VERTICAL COUNTER TO THE NEXT HORIZONTAL ROW.

IF ONE OF THE ROW SWITCHES IS TURNED OFF, THE VERTICAL COUNTER WILL SKIP AHEAD TO THE NEXT ROW THAT IS TURNED ON.

HORIZONTAL COUNTER

THIS IS A TEN-SECTION RING COUNTER SIMILAR TO THE VERTICAL COUNTER. THE TRIGGER PULSES THAT DRIVE THE COUNTER ARE OBTAINED FROM THE PLUG-IN UNIT. AS EACH MULTIVIBRATOR IN THE HORIZONTAL COUNTER IS SWITCHED, IT "GATES ON" AMPLIFIERS IN THE OUTPUTS OF BOTH THE PRIMARY AND SECONDARY MATRIX NETWORKS. AS EACH AMPLIFIER IS GATED ON, THE VOLTAGE LEVEL SET BY THE MATRIX CONTROLS IS AMPLIFIED AND THEN COUPLED TO A COMMON-OUTPUT CATHODE FOLLOWER (V105A-B). THIS OUTPUT IS CONNECTED DIRECTLY TO THE PLUG-IN UNIT.

MATRIX NETWORKS

EACH OF THE TWO MATRIX NETWORKS CONSISTS OF FIFTY CONTROLS, TEN CATHODE FOLLOWERS AND TEN GATED AMPLIFIERS. THE GRID OF EACH CATHODE-FOLLOWER IS CONNECTED TO FIVE DIODES. ONLY ONE OF THESE DIODES WILL BE FORWARD BIASED WHILE ALL OTHERS ARE BACK BIASED. SINCE THE DIODES ARE CONNECTED TO THE WIPERS OF THE MATRIX CONTROLS, THE VOLTAGE APPLIED TO THE CATHODE FOLLOWER GRID DEPENDS ON THE SETTING OF THE CONTROL.

FROM THE CATHODE FOLLOWER, THIS SIGNAL VOLTAGE PASSES DIRECTLY TO THE SUPPRESSOR GRID OF THE GATED AMPLIFIERS AND ON TO THE OUTPUT CATHODE FOLLOWER.

SECTION 4

CALIBRATION AND MAINTENANCE

GENERAL INFORMATION

THIS SECTION INCLUDES THE CALIBRATION PROCEDURE FOR THE TYPE 200 AND A GENERAL MAINTENANCE GUIDE.

USE THIS SECTION WHENEVER THE TYPE 200 FAILS TO OPERATE OR DOES NOT MEET SPECIFICATIONS. THE FIRST PORTION OF THIS SECTION CONTAINS GENERAL MAINTENANCE INFORMATION AND THE LATTER PORTION INCLUDES CALIBRATION PLUS MORE SPECIFIC TROUBLESHOOTING DATA.

VISUAL INSPECTION

VISUAL INSPECTION SHOULD BE THE FIRST STEP IN ANY TROUBLESHOOTING TECHNIQUE. VISUAL INSPECTION INCLUDES NOT ONLY A CHECK OF CONTROL SETTINGS BUT INTER-RELATED ITEMS SUCH AS LOOSE OR BROKEN CONNECTIONS, BURNT COMPONENTS, BLOWN FUSES, IMPROPERLY SEATED TUBES, ETC. IF ANY BURNT COMPONENTS ARE DISCOVERED, LOOK FOR OTHER, LESS OBVIOUS, CAUSES OF TROUBLE. BURNT COMPONENTS ARE USUALLY CAUSED BY SOME OTHER FAULT IN THE CIRCUIT SUCH AS A SHORTED TUBE ELEMENT OR CAPACITOR.

TUBE CHECKS

THE BEST WAY TO CHECK A VACUUM TUBE IS BY SUBSTITUTING IT WITH ANOTHER TUBE OF THE SAME TYPE THAT IS KNOWN TO BE GOOD. AFTER A TUBE HAS BEEN CHECKED IN THIS MANNER, RETURN IT TO ITS ORIGINAL LOCATION. THIS HELPS AVOID THE NEED FOR RECALIBRATION BECAUSE OF SLIGHT DIFFERENCES BETWEEN TUBES OF THE SAME TYPE.

POWER SUPPLY VOLTAGES

A FAILURE IN ONE OF THE POWER SUPPLY VOLTAGES CAN CAUSE A WIDE VARIETY OF TROUBLE SYMPTOMS. DUE TO THIS, MAKE SURE THE POWER SUPPLIES ARE FUNCTIONING BEFORE GOING ON WITH DETAILED TROUBLESHOOTING.

CALIBRATION AND MAINTENANCE SEQUENCE

FOLLOW THE STEPS IN THIS PROCEDURE IN THE ORDER GIVEN. THE STEPS ARE ARRANGED TO AVOID UNNECESSARY REPETITION OF CALIBRATION STEPS AND TO PROVIDE A LOGICAL TROUBLESHOOTING GUIDE.

EQUIPMENT REQUIRED

THE FOLLOWING EQUIPMENT IS REQUIRED FOR A COMPLETE CALIBRATION OF THE TYPE 200:

CALIBRATION AND MAINTENANCE

EQUIPMENT REQUIRED (CONTINUED)

1. A TEST OSCILLOSCOPE WITH THE FOLLOWING SPECIFICATIONS

INPUT IMPEDANCE	AT LEAST 1 MEGOHM
HORIZONTAL SWEEP ACCURACY	3%
AN EXTERNAL TRIGGER INPUT	

2. VOLTMETER WITH A SENSITIVITY OF AT LEAST 20,000 OHMS PER VOLT AND AN ACCURACY OF AT LEAST 1%.

3. VARIABLE LINE VOLTAGE SOURCE FROM 105 TO 125 VOLTS.

1. POWER SUPPLY ADJUSTMENT AND CHECKS

-210 VOLT ADJUSTMENT

WITH THE VOLTMETER, MEASURE THE VOLTAGE OF THE -210 VOLT POWER SUPPLY. IF THE VOLTAGE DOES NOT MEASURE EXACTLY 210 VOLTS ON THE VOLTMETER, ADJUST THE -210V ADJ.

TROUBLESHOOTING NOTE

IF THERE IS NO POWER:

- (1) CHECK THERMAL CUTOFF AND FUSE.
- (2) CHECK V101 BY SUBSTITUTION.
- (3) CHECK V103 BY SUBSTITUTION.
- (4) CHECK V102 BY SUBSTITUTION.
- (5) CHECK V104 BY SUBSTITUTION.
- (6) CHECK LINE VOLTAGE (105 TO 125 VOLTS)
- (7) CHECK RESISTANCE OF R131 AND R133.
- (8) CHECK DIODES D109 THROUGH D112 FOR OPEN OR SHORT.
- (9) CHECK C104 FOR SHORT OR OPEN.
- (10) CHECK LOAD RESISTANCE.

POWER SUPPLY VOLTAGE CHECK

WITH THE VOLTMETER, CHECK THE VOLTAGE ON THE +100, +250 AND THE -55 VOLT SUPPLIES; VOLTAGE SHOULD MEASURE $\pm 3\%$ ON EACH SUPPLY.

TROUBLESHOOTING NOTE

IF THE +100 VOLT SUPPLY IS NOT CORRECT:

- (1) CHECK V106 AND V107.
- (2) CHECK RESISTANCE OF R115 AND R116.
- (3) CHECK DIODES D105 THROUGH D108 FOR OPEN OR SHORT.
- (4) CHECK C102 FOR SHORT OR OPEN.
- (5) CHECK LOAD RESISTANCE.

IF THE +250 VOLT SUPPLY IS NOT CORRECT:

CALIBRATION AND MAINTENANCE

POWER SUPPLY VOLTAGE CHECK

TROUBLESHOOTING NOTE (CONTINUED)

IF THE +250 VOLT SUPPLY IS NOT CORRECT:

- (1) CHECK V107 AND V108.
- (2) CHECK RESISTANCE OF R106, R107 AND R142.
- (3) CHECK DIODES D101 THROUGH D104 FOR OPEN OR SHORT
- (4) CHECK C101 FOR SHORT OR OPEN.
- (5) CHECK LOAD RESISTANCE.

IF THE -55 VOLT SOURCE IS NOT CORRECT:

- (1) CHECK V313.
- (2) CHECK R378
- (3) CHECK C316

POWER SUPPLY RIPPLE CHECK

WITH THE OSCILLOSCOPE (OR SENSITIVE PEAK-TO-PEAK, AC VOLTMETER), MEASURE THE PEAK-TO-PEAK RIPPLE VOLTAGE ON THE -210, +100 AND THE +250 VOLT SUPPLIES. MAXIMUM RIPPLE ON THE -210 VOLT SUPPLY IS 10 MILLIVOLTS; MAXIMUM RIPPLE ON THE OTHER SUPPLIES IS 15 MILLIVOLTS

TROUBLESHOOTING NOTE

USE THE SAME TROUBLESHOOTING INFORMATION AS GIVEN FOR THE "POWER SUPPLY VOLTAGE CHECK."

POWER SUPPLY REGULATION CHECK

VARY THE LINE VOLTAGE FROM 105 TO 125 VOLTS AND CHECK ALL POWER SUPPLY VOLTAGES. ALL VOLTAGES SHOULD REMAIN WITHIN $\pm 3\%$.

TROUBLESHOOTING NOTE

USE THE SAME TROUBLESHOOTING INFORMATION AS GIVEN FOR THE "POWER SUPPLY VOLTAGE CHECK."

2. DECADE TRIGGER ADJUSTMENT AND CHECKS

UNIT SWITCHING CHECK

CONNECT THE TEST OSCILLOSCOPE AS FOLLOWS:

EXTERNALLY TRIGGERED FROM SYNC OUT OF PLUG-IN UNIT.
CONNECT PROBE OF TEST SCOPE TO THE COMMON CATHODE
CIRCUIT OF V205, V210, ETC.

CALIBRATION AND MAINTENANCE

DECADE TRIGGER ADJUST - UNIT SWITCHING CHECK (CONTINUED)

SET THE PLUG-IN UNIT FOR NORMAL, INTERNAL OPERATION. CHECK FOR THE PRESENCE OF TRIGGER PULSES AS VIEWED ON THE TEST OSCILLOSCOPE. THE TRIGGER PULSES SHOULD BE ABOUT 10 TO 30V P-P WITH AN AVERAGE DC LEVEL OF APPROXIMATELY $-100V \pm 5V$ AND AT THE RATE SET BY THE PLUG-IN. CHECK THE NEON ROW INDICATORS OF THE TYPE 200 FOR SEQUENTIAL OPERATION.

TROUBLESHOOTING NOTE

IF NO TRIGGER PULSES ARE OBSERVED:

- (1) MAKE SURE THE PLUG-IN UNIT IS OPERATING; TRY ADJUSTING THE UNIT TRIG ADJ. OF THE PLUG-IN OR TRY ANOTHER PLUG-IN UNIT.

IF THE NEON INDICATORS FAIL TO SHOW CONTINUOUS OR SEQUENTIAL OPERATION:

- (1) CHECK V205, V210, V215, ETC., BY SUBSTITUTION.
- (2) CHECK V104, V209, V214, ETC., BY SUBSTITUTION.
- (3) REMOVE READOUT TUBES, V202, V203, V207, V208, ETC., ONE AT A TIME, IN AN EFFORT TO ISOLATE THE FAULTY TUBE.

ADJUSTMENT OF DECADE TRIGGER

MAKE SURE ALL ROW SWITCHES OF THE TYPE 200 ARE ON. CONNECT THE TEST OSCILLOSCOPE AS FOLLOWS:

EXTERNALLY TRIGGER THE TEST OSCILLOSCOPE FROM THE SYNC OUT OF THE PLUG-IN UNIT. CONNECT THE PROBE OF THE TEST OSCILLOSCOPE TO THE PRIMARY MATRIX OUTPUT OF THE PLUG-IN UNIT OR AT THE CATHODE OF V105^A IN THE TYPE 200.

SET THE DECADE TRIG ADJ* FOR CONTINUOUS TRIGGERING PULSES ON THE TEST OSCILLOSCOPE WHILE THE TIME/INCREMENT SWITCH OF THE PLUG-IN UNIT IS VARIED THROUGHOUT ITS RANGE.

TROUBLESHOOTING NOTE

IF THE TRIGGERING PULSES ARE NOT CONTINUOUS OR OTHERWISE IMPROPER:

- (1) MAKE SURE THE UNIT TRIG ADJ IN THE PLUG-IN UNIT IS SET PROPERLY.
- (2) CHECK FOR A BAD ROW SWITCH.

*ON SOME TYPE 200 INSTRUMENTS THIS ADJUSTMENT MAY BE LABELED VERT TRIG.

7
CALIBRATION AND MAINTENANCE

DECADE TRIGGER ADJUST - UNIT SWITCHING CHECK

TROUBLESHOOTING NOTE (CONTINUED)

- (3) CHECK FOR THE PRESENCE OF A 5-VOLT PULSE AT THE GRID OF V317B.
- (4) CHECK V317B BY SUBSTITUTION.
- (5) CHECK V303, V306, ETC., BY SUBSTITUTION.
- (6) CHECK V302, V305, ETC., BY SUBSTITUTION.
- (7) CHECK T201 AND D2100 FOR SHORT AND OPEN.

LINE VOLTAGE vs TRIGGERING

LEAVE THE TEST OSCILLOSCOPE CONNECTED THE SAME WAY AS THE PREVIOUS ADJUSTMENT. VARY THE LINE VOLTAGE FROM 105 TO 125 VOLTS AND INSURE THAT CONTINUOUS TRIGGERING IS MAINTAINED.

TROUBLESHOOTING NOTE

USE THE SAME TROUBLESHOOTING INFORMATION AS GIVEN FOR THE PREVIOUS ADJUSTMENT.

3. PRIMARY AND SECONDARY MATRIX READOUT

CONNECT TEST OSCILLOSCOPE AS FOLLOWS:

EXTERNALLY TRIGGER THE TEST OSCILLOSCOPE FROM THE PLUG-IN UNIT SYNC OUT. CONNECT THE PROBE OF THE TEST OSCILLOSCOPE TO THE PRIMARY MATRIX OUTPUT OF THE PLUG-IN UNIT. SET THE SWEEP RATE OF THE OSCILLOSCOPE SO THAT SEVERAL INCREMENTS ARE VIEWED.

PRIMARY MATRIX COMP. ADJUSTMENT

ADJUST THE PRIMARY MATRIX COMP. (C201) FOR THE SQUAREST AND FLATTEST TOPPED INCREMENTS. IT MAY BE NECESSARY TO TURN SOME OF THE PRIMARY CONTROLS OF THE TYPE 200 TO BETTER DEFINE THE INDIVIDUAL INCREMENTS.

TROUBLESHOOTING NOTE

IF THIS ADJUSTMENT CANNOT BE ACCOMPLISHED:

- (1) CHECK V105 BY SUBSTITUTION.
- (2) CHECK C201.

MAINTAIN THE SAME TEST OSCILLOSCOPE CONNECTIONS FOR THE NEXT ADJUSTMENT.

CALIBRATION AND MAINTENANCE

PRIMARY AND SECONDARY MATRIX READOUT (CONTINUED)

PRIMARY MATRIX H.F. ADJ.

ON THE PLUG-IN UNIT, SET THE TIME/INCREMENT SWITCH TO $10\mu\text{SEC}$. TURN ALL PRIMARY MATRIX CONTROLS OF THE TYPE 200 FULLY COUNTERCLOCKWISE EXCEPT ONE. SET THE CONTROLS OF THE TEST OSCILLOSCOPE TO DISPLAY THE ONE INCREMENT. ADJUST THE PRIMARY MATRIX H.F. ADJ (L201) FOR THE SHARPEST LEADING CORNER OF THE DISPLAYED PULSE WITHOUT OVERSHOOT.

TROUBLESHOOTING NOTE

IF THIS ADJUSTMENT CANNOT BE ACCOMPLISHED:

- (1) CHECK V105 BY SUBSTITUTION
- (2) CHECK L201

SECONDARY MATRIX COMP. ADJUSTMENT

CONNECT THE TEST OSCILLOSCOPE AS FOLLOWS:

EXTERNALLY TRIGGER THE TEST OSCILLOSCOPE FROM THE SYNC OUTPUT OF THE PLUG-IN UNIT. CONNECT THE PROBE OF THE TEST OSCILLOSCOPE TO THE SECONDARY MATRIX OUTPUT OF THE PLUG-IN UNIT.

ADJUST THE SECONDARY MATRIX COMP (C201s) FOR THE SQUAREST AND FLATTEST TOPPED INCREMENTS. IT MAY BE NECESSARY TO TURN SOME OF THE SECONDARY MATRIX CONTROLS OF THE TYPE 200 TO BETTER DEFINE THE INDIVIDUAL INCREMENTS.

TROUBLESHOOTING NOTE

IF THIS ADJUSTMENT CANNOT BE ACCOMPLISHED:

- (1) CHECK V105 BY SUBSTITUTION
- (2) CHECK C201s.

MAINTAIN THE SAME TEST OSCILLOSCOPE CONNECTIONS FOR THE NEXT ADJUSTMENT.

SECONDARY MATRIX H.F. ADJ.

ON THE PLUG-IN UNIT, SET THE TIME/INCREMENT SWITCH TO $10\mu\text{SEC}$. TURN ALL SECONDARY MATRIX CONTROLS OF THE TYPE 200 FULLY COUNTERCLOCKWISE EXCEPT ONE. SET THE CONTROLS OF THE TEST OSCILLOSCOPE TO DISPLAY THE ONE INCREMENT. ADJUST THE SECONDARY MATRIX H.F. ADJ (L201s) FOR THE SHARPEST LEADING CORNER OF THE DISPLAYED PULSE WITHOUT OVERSHOOT.

CALIBRATION AND MAINTENANCE

PRIMARY AND SECONDARY MATRIX READOUT

SECONDARY MATRIX H.F. ADJ (CONTINUED)

TROUBLESHOOTING NOTE

IF THIS ADJUSTMENT CANNOT BE ACCOMPLISHED:

(1) CHECK V105 BY SUBSTITUTION.

(2) CHECK L201s.

MAINTAIN THE SAME TEST OSCILLOSCOPE CONNECTIONS FOR THE NEXT ADJUSTMENT

4. READOUT LEVEL AND COMPENSATION ADJUSTMENT

ON THE TYPE 200, SET THE FIRST TEN (TOP ROW) PRIMARY AND SECONDARY MATRIX LEVEL CONTROLS TO MIDRANGE. ON THE PLUG-IN UNIT, SET THE TIME/ INCREMENT SWITCH TO 10 μ sec.

READOUT LEVEL ADJ.

SET THE READOUT LEVEL ADJ (R2154) FOR THE BEST COMPROMISE OF SMALLEST POSITIVE AND NEGATIVE SPIKES AS SHOWN ON THE TEST OSCILLOSCOPE. (+150V $\pm$ 5V).

SECONDARY READOUT COMP. ADJUSTMENT

SET EACH SECONDARY READOUT COMP. ADJUSTMENT (C2011 THROUGH C2020) FOR THE BEST COMPROMISE OF SMALLEST SPIKES ON THE INDIVIDUAL SWITCHING INCREMENTS.

TROUBLESHOOTING NOTE

IF THIS ADJUSTMENT CANNOT BE ACCOMPLISHED:

(1) CHECK THE TRIMMER.

(2) CHECK THE CORRESPONDING READOUT TUBE (I.E. V203, V208, ETC.) BY SUBSTITUTION.

CONNECT THE PROBE OF THE TEST OSCILLOSCOPE TO THE PRIMARY MATRIX OUTPUT OF THE PLUG-IN UNIT FOR THE NEXT ADJUSTMENT

PRIMARY READOUT COMP. ADJUSTMENT

SET EACH PRIMARY READOUT COMP. ADJUSTMENT (C2001 THROUGH C2010) FOR THE BEST COMPROMISE OF SMALLEST SPIKES ON THE INDIVIDUAL SWITCHING INCREMENTS.

CALIBRATION AND MAINTENANCE

READOUT LEVEL & COMP ADJ - PRIMARY READOUT (CONTINUED)

TROUBLESHOOTING NOTE

IF THIS ADJUSTMENT CANNOT BE ACCOMPLISHED:

- (1) CHECK THE TRIMMER.
- (2) CHECK THE CORRESPONDING READOUT TUBE.
(I.E. V202, V207, ETC.) BY SUBSTITUTION.

MAINTAIN THE SAME TEST OSCILLOSCOPE CONNECTIONS FOR THE NEXT ADJUSTMENT.

5. MATRIX OPERATION CHECK

VOLTAGE RANGE OF PRIMARY AND SECONDARY INCREMENTS

VARY EACH PRIMARY MATRIX LEVEL CONTROL ON THE TYPE 200 TO INSURE THAT EACH INCREMENT HAS A 10-VOLT RANGE.

CONNECT THE PROBE OF THE TEST OSCILLOSCOPE TO THE SECONDARY MATRIX OUTPUT OF THE PLUG-IN UNIT. VARY EACH SECONDARY MATRIX LEVEL CONTROL OF THE TYPE 200 TO INSURE THAT EACH INCREMENT HAS A 10-VOLT RANGE.

TROUBLESHOOTING NOTE

IF THE SAME INCREMENT IN EACH HORIZONTAL ROW DOES NOT HAVE THE PROPER RANGE OR INTERACTS WITH ADJACENT INCREMENTS, CHECK THE CORRESPONDING READOUT TUBE (I.E. V202, V203, ETC.) BY SUBSTITUTION. IF ONE OR MORE UNRELATED INCREMENTS DO NOT HAVE THE PROPER VOLTAGE RANGE, LOOK FOR A BAD MATRIX DIODE (I.E. D201, D201s, D202, D202s, ETC.) OR A BAD MATRIX LEVEL POT.

CHECK NEON ROW INDICATORS

SET THE TIME/INCREMENT SWITCH OF THE PLUG-IN UNIT TO 100MSEC AND INSURE THAT ALL NEON INDICATORS ARE LIGHTING SEQUENTIALLY.

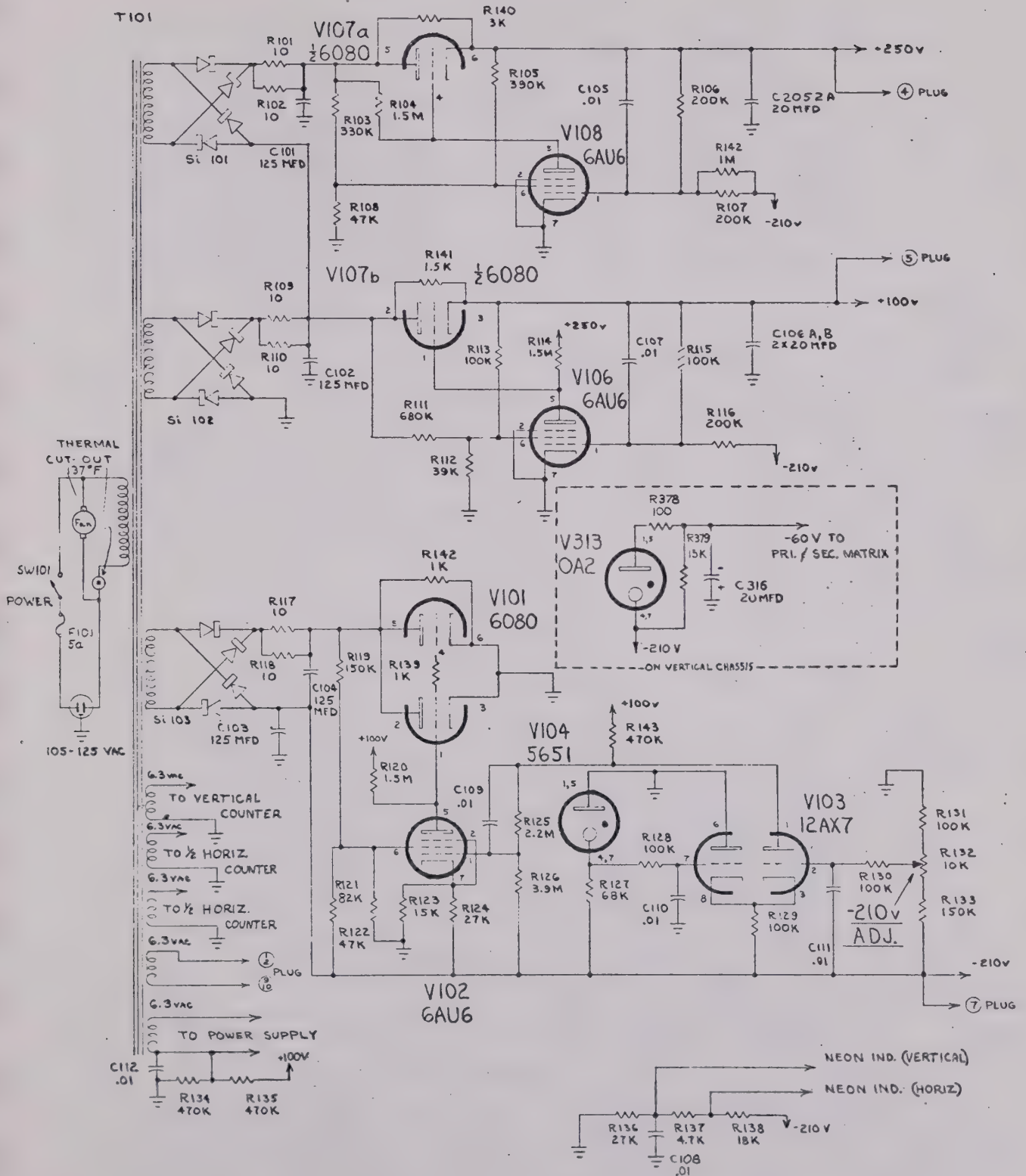
TROUBLESHOOTING NOTE

IF THE BULBS DO NOT LIGHT PROPERLY:

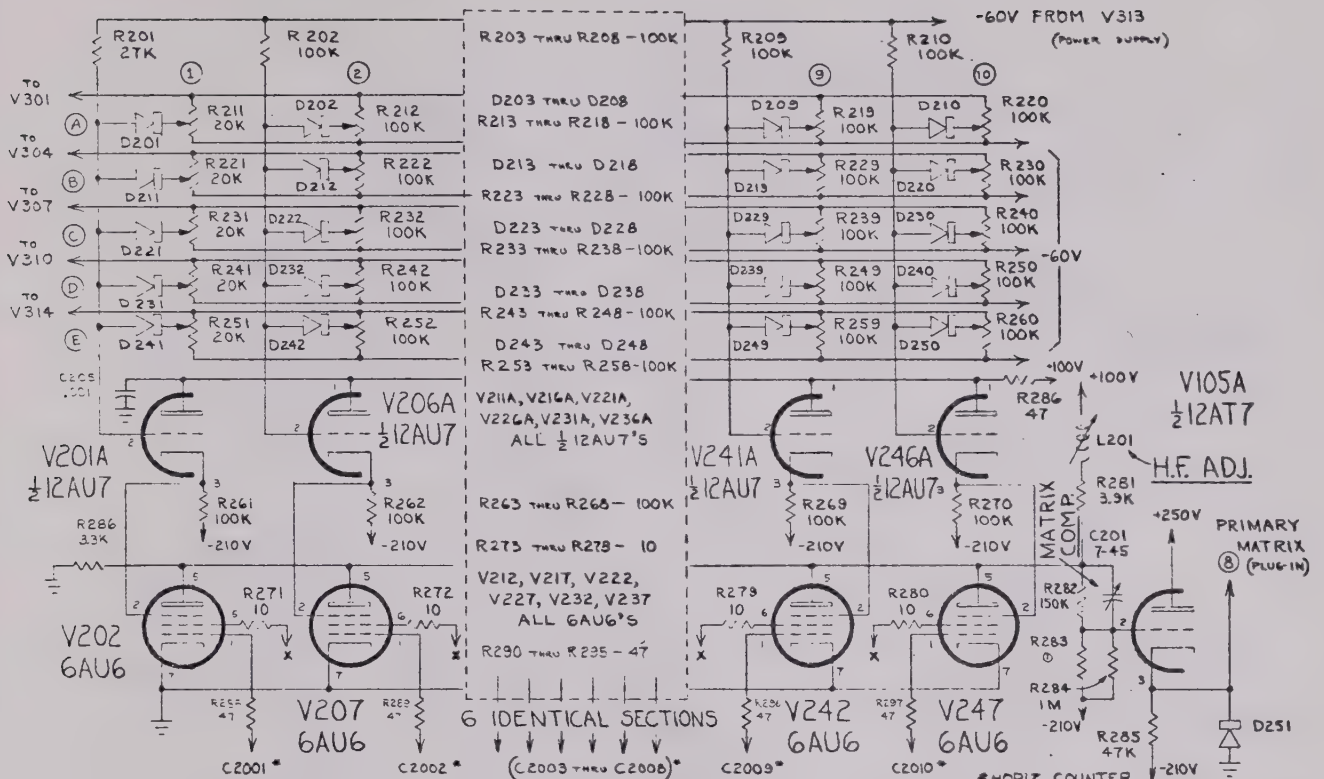
- (1) CHECK THE BULB SUPPLY VOLTAGE.
- (2) REPLACE THE BULB.

POWER SUPPLY

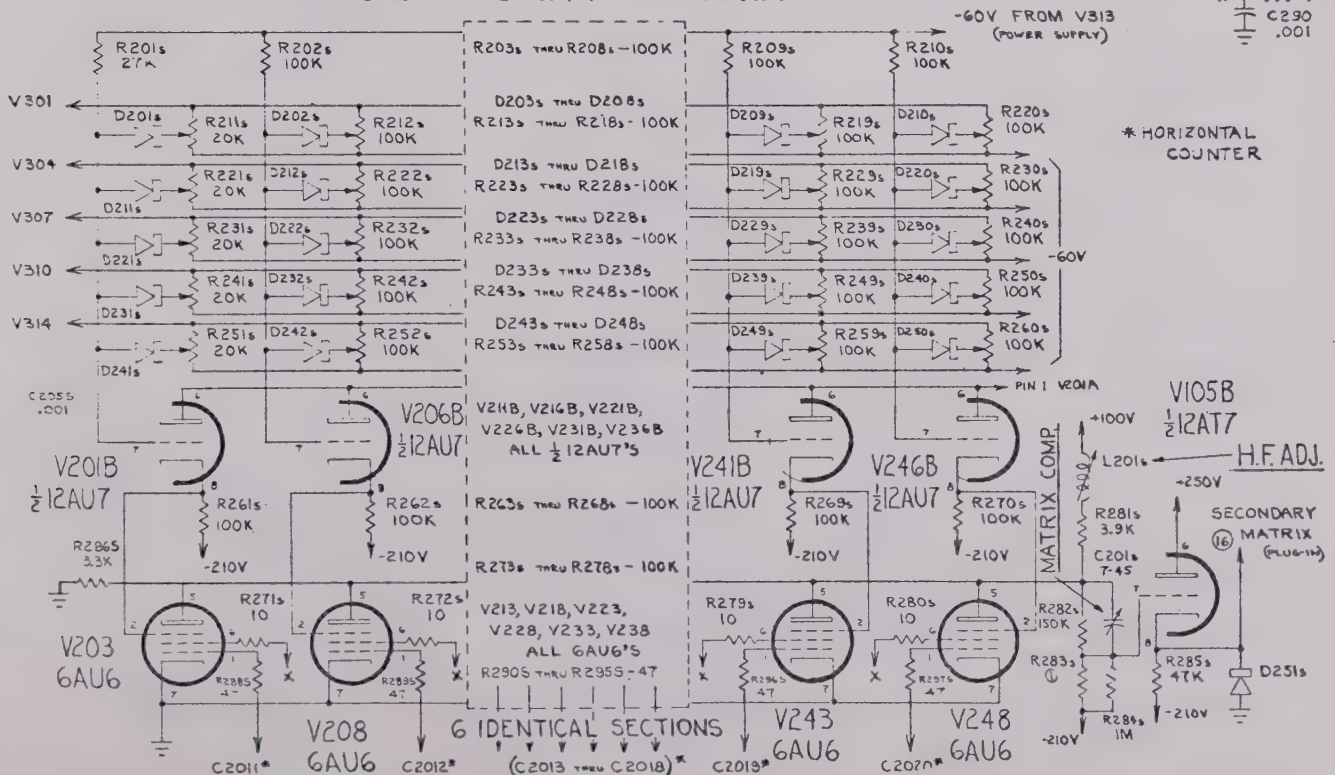
T101



PRIMARY MATRIX

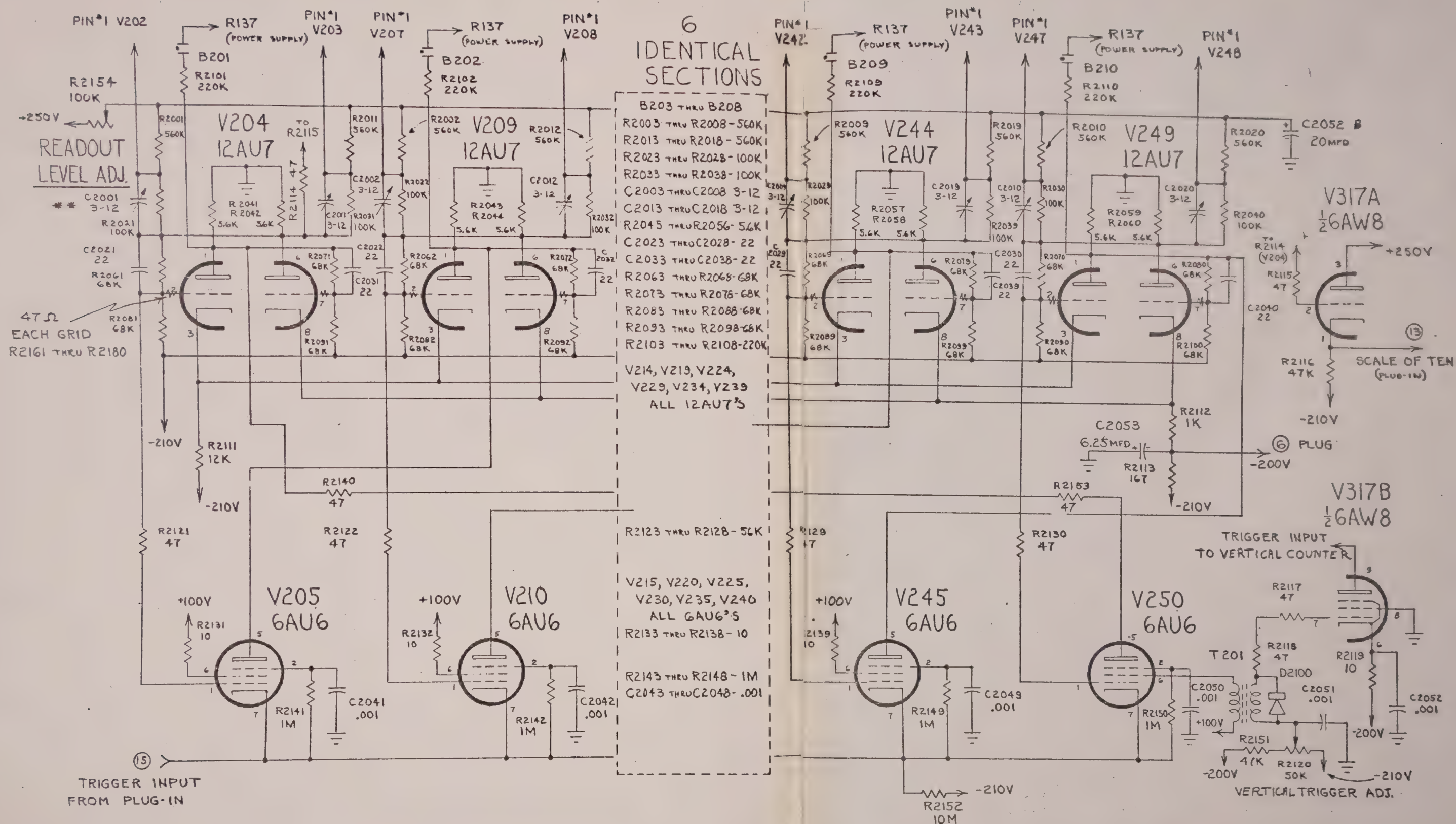


SECONDARY MATRIX



① SELECTED VALUE

HORIZONTAL COUNTER



** C2001 THRU C2010 ARE PRIMARY READOUT COMP.
 * C2011 THRU C2020 ARE SECONDARY READOUT COMP.

TYPE 200 WAVEFORM SYNTHESIZER

3-2-62
 FAT
 TYP

SPECIAL INSTRUCTIONS WHEN USING CLAMP MODE IN THE "G"

The No. 1 increment will act as a positioning control for the start of the waveform rather than as a true slope control as it does in normal operation. Because of this, a waveform that you have set up in normal operation will appear differently in lock-out position.

To readjust to the waveform desired, simply press the Reset button rapidly and adjust the first increment.

FUNCTIONAL EXPLANATION: In normal operation, each slope is generated by the difference in voltage levels of the potentiometers. It is a continuous operation so that in going from the 50th to the first increment, the results are the same as in going between any other two increments. In Lockout operation the 50th increment is completed and the unit switches back to the beginning of the first increment and locks out. The slope generator, therefore, has already risen to its operating level and when the Reset button is pressed or an external trigger introduced, the waveform gravels to the setting of the second increment. An adjustment of the first increment merely determines the point at which the waveform starts.

OPERATING PROCEDURE

1. GENERAL

A. BASIC OPERATION

1. Turn all row switches On in Type 200.
2. Turn the first 10 or 15 Secondary Matrix (red) knobs to random settings.
3. Set TIME/INCREMENT to 100 μ sec.
4. Connect negative or positive output to monitor scope input.
5. Connect Mult Row to external trigger input of scope.
6. Set Trigger Source to Int.
7. Set Trigger Mode to Normal.

You should be observing a random waveform composed of 50 slopes or segments, each having a duration of 100 μ sec. Adjust scope triggering so that #1 increment is at beginning of trace.

8. Vary the Secondary Matrix (red) knobs and notice the individual slopes vary. Following increments will change level since the "finish" point for one slope is the "start" point for the next.
9. The Primary Matrix (black) knobs will have no effect on the negative or positive output and should be turned full CCW.
10. Switch Off various rows in the Type 200 and notice that sections of the waveform disappear.
11. Change Time/Increment switch and notice the increment time vary as a group without changing the waveform ratio.

B. AUXILIARY OUTPUTS AND CONTROLS

1. Output Amplitude control varies overall waveform amplitude without effecting ratio of individual amplitudes.
2. Mult row is used to trigger monitor scope when you are switching two or more rows.
3. Row 1 is used to trigger monitor scope when only one row is On.

C. INTERNAL - TEN COUNT

In this position, each increment duration is the same as in the Internal-Normal operation. However, any one of the rows of ten increments can be sequentially triggered by the Reset button (manual operation) or externally. The Reset button or an external trigger "unlocks" the next row of ten increments to be switched and lets them run at the rate already determined by the Time/Increment switch. The repetition rate cannot exceed the sum of the durations of the ten increments being triggered plus a short "hold-off" time between rows.

When using a monitor scope, trigger it from the 1 row in this mode of operation.

D. INTERNAL - PROGRAM COUNT

In this position again, the individual increment duration is determined by the Time/Increment switch as in Internal-Ten Count operation. As in the Internal-Ten Count operation, the Reset button or the external trigger unlocks a group of increments, only this time it is the whole program of 20, 30, 40 or 50 increments (depending on how many rows are turned on in the Type 200). Each trigger will cause the program to start at #1 increment in row A and run sequentially through the number of rows switched On and return to #1 increment where it will wait for the next trigger. The repetition rate cannot exceed the sum of the duration of all the increments in the full program plus a short "hold-off" time between programs.

When using a monitor scope, trigger it from Mult row in this mode of operation.

E. EXTERNAL - TEN COUNT OR PROGRAM COUNT

This mode will have very limited application. Pressing the Reset button will "arm" or make the Trigger Input ready to receive external triggers. The Manual Trigger or an external trigger can now be used to trigger the increments one at a time through a count of ten or the whole program, depending on the Trigger Mode setting.

00

00

00

00

00

00

00

STEP 11
d.2

⊖

STEP 9.1.

⊖

C3IF

⊖

RIISB

00

00

00

00

00

00

00

00

00

FRONT PANEL

STEP 13 a.



STEP 11 c.
↓ MONITORING
+ OUTPUT

STEP 12 b.
↓ MONITORING
- OUTPUT

STEP 11 d.3
① ①

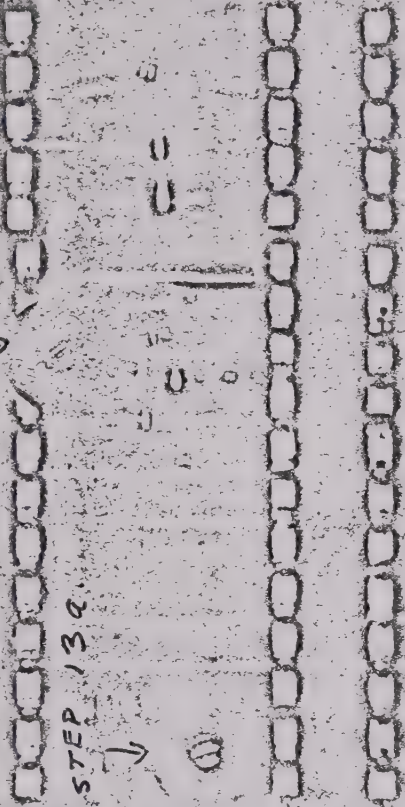
STEP 12 a.
↓ MONITORING
- OUTPUT

STEP 11 b.
↓ MONITORING
+ OUTPUT

STEP 9 g
C 316

STEP 14 e

STEP 13 a.



STEP 11 d.1.

STEP 9 h
↓ CAPACITOR
NEXT TO
NEON

STEP 13

FRONT PANEL

CALIBRATION PROCEDURE FOR "G" PLUG-IN

1. All rows on 200 CCW. 200 off
2. Center all adjustments. Center clamp adjustment on front panel.
3. Make power supply res. check.
4. Insert "G" plug-in into 200 using extender
5. Plug-in settings
 - a. Output amp. $\pm$ full CW
 - b. Time increment
 1. var. full CW
 2. time 1 ms
 - c. Main output
 1. normal
 - d. Trigger
 1. int.
6. Turn on 200
7. Check for approx. value sawtooth pin 8 of V-2. Adjust rate timing pot for sawtooth approx. time (1 ms per cycle) & 50V amplitude
8. Turn all rows off, make sure light is on, on first row)
 - a. Connect vert amp of scope to sync out, 1 row jack - connect trig of scope to one row out)
 - b. Adjust horz. trig keeping 9th count low
 1. observe 10 counts on scope
9. Adjust timing
 - a. Set primary matrix
 1. 1st one CCW, 2nd CW & etc. leaving 10th centered
 - b. Connect vert amp. scope to primary matrix out (trig scope on 1 row jack)
 - c. Set time/increment to 33 ms. Adjust rate timing for correct timing
 - d. Set time/increment to 10 ms. Adjust R113B (Black pot on timing switch) for correct timing
 - e. Repeat steps C & D until both conditions are within 3%
 - f. Check expansion control (time variable) for greater than 3 to 1.
 - g. Set time/increment to 33 μ s. Adjust C316 for correct timing.
 - h. Set time/increment to 330 ms. Adjust CAP on ceramic strip for correct timing. (8-12 pf on ceramic strip adjacent to neon)
 - i. Set time/increment to 100 ms. Adjust CAP C31F on bottom of timing SW for correct timing.
 - j. Repeat steps G to I until all are within 3% of correct timing.
10. Set primary matrix. First 2 on. Second 2 off & etc.

11. Monitor + main output. Time/increment 1 MS
Turn all rows of 200 on
 - a. Adj. slope bal for + & - slopes until equal.
 - b. Adj + min amp DC level for OV DC with output at min. amp.
 - c. Adj max amp DC level for OV DC with output at max amplitude.
 - d. Repeat B & C until both conditions are met. Adjust CAPS on rear of timing SW for high freq. slopes.
 1. 33 ms. time/increment one on top
 2. 100 ms. time/increment one in bottom
 3. Go to 330 ms. time/increment turn on enough increments in second row and make 3 triangles. Adj. two trimmer pots on second ceramic strip left side. When moving variable adj. so waveforms remain the same amplitude when in calibrate or fully expanded.
12. Go to main - output. Should be inverted output and slightly greater in amplitude.
 - a. Adj min - amp. for OV DC level with output at min amplitude
 - b. Adj max - amp., adj. for OV DC level with output at max amplitude
 - c. Repeat A & B until both conditions are met.
13. Adj. clamp. Put main output in clamp position
 - a. Adj. trimmer pot & schmitt current for proper waveform and clamp (pot on back ceramic strip left side)
 - b. Adj 20 turn pot on front panel for OV DC level (check clamp for max & min adj with pot)
 - c. Check to see that it stays in clamp to highest range (Make sure 50th increment doesn't pull 1st increment out of clamp)
14. Lockout Adjust
 - a. Set trigger mode ext 1 increment
 - b. Apply signal from calibrator on scope
 - c. Adj. rate gen stability so instr. will run on 10V but not 5V
 - d. Remove input from scope trigger with manual pushbutton to see that instr. will trigger one increment each time button is pushed.
 - e. Set trigger mode to one row depress manual trigger and make sure 200 will trigger one row each time button is pushed and stops on first increment (adj pot on rear strip right under main chassis)
 - f. Set trigger mode on mult row, depress manual trigger and make sure 200 will go thru all rows and locks out on first increment (adj same pot as above until both conditions are met)

TOLERANCES (EXCEPT AS NOTED)	DECIMAL	FRACTIONAL	ANGULAR	DATE	DRAWING
	$\pm$	$\pm$	$\pm$		

2/68

TYPE G VARIABLE SLOPE GENERATOR

